

FOOTROT DIAGNOSIS



Identifying Footrot in the field

Key messages

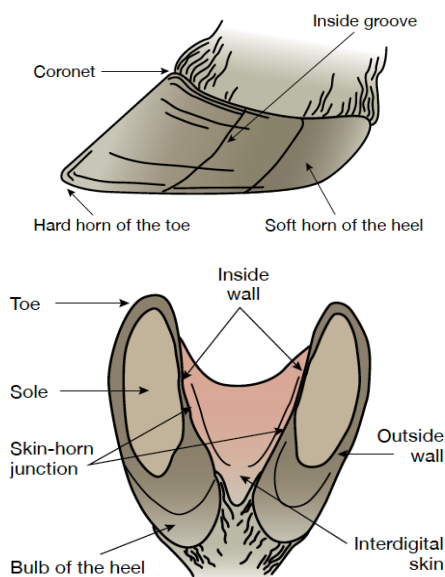
- Lameness is the first sign of footrot. Inspect sheep with signs of lameness promptly.
- Footrot can be difficult to diagnose and differentiate from other common foot and lower-leg diseases and conditions in sheep and goats.
- A scoring system is used to describe the signs and progression of footrot. Score 0 is a healthy foot, Score 1 is the mildest stage of the disease through to Score 5, which is the most advanced stage.
- There are many strains (or types) of footrot bacteria (*Dichelobacter nodosus*) which vary in their ability to cause disease from benign to extremely virulent.
- Laboratory tests can confirm the presence of footrot and decide the virulence status of any footrot infection.

Before you can diagnose footrot, you must know the structure of a sheep's healthy foot and where to look for the changes that occur with footrot. Figure 1 shows the structure of the hoof.

- The interdigital skin (webbing).
- The inside skin of the toes and the soft horn of the heel.
- The skin/horn junction.
- The sole of the heel.

The characteristic signs of footrot, in progressive order are red moist skin between the toes, with a smelly grey, creamy colour paste-like exudate between the toes. Separation (or underrunning) of the horn from the soft underlying structures usually starts at the skin horn junction of the heel and is often symmetrical affecting both claws, unlike other foot conditions such as foot abscess.

Figure 1: Structure of the sheep's foot - views from the side and underside of the hoof.



How to diagnose footrot

Lameness is often the first sign of footrot. There are several other conditions which cause lameness, which means it is essential to make an informed diagnosis. An incorrect diagnosis may lead to substantial economic loss due to inappropriate management.

Other conditions that may be confused with footrot include foot abscess, toe abscess, OID (ovine interdigital dermatitis), shelly hoof, scabby mouth, strawberry footrot, laminitis, arthritis, and grass seed impaction

Refer to Module 4: Treatment and Control for a detailed description of these conditions.

Disease differentiation

Differentiating between the different causes of lameness can be difficult and expert help should be sought to diagnose the cause of the problem.

It is important to consider the history of the sheep as environmental conditions, breed and earlier treatment such as footbathing will affect the clinical expression of disease.

Field diagnosis of lameness requires many sheep in several mobs to be carefully examined, and foot scored. It is not sufficient to tip over a few sheep to make a diagnosis.

Initially, it is safest to examine sheep yarded in the paddock. This will avoid possible cross infection of other mobs that use the same laneways or sheep yards.

When lameness is first observed at least 20-100 sheep in a mob should be examined. All four feet must be examined for any abnormalities.

If no footrot lesions are found in a 100 sheep examined at random (assuming conditions have been suitable for the expression of footrot) then another cause of the observed

lameness should be diagnosed and a suitable treatment given.

If separation of the horn from the foot is observed (footrot lesions $\geq$ Score 3, refer Figure 2), then virulent footrot must be considered and expert advice sought as it is a notifiable disease.

Sometimes sheep need to be identified, foot scored and re-examined 2-3 weeks later. Progression from Score 2/3 to Score 4 in this period is indicative of virulent footrot.

If any sheep have under run (horn separating from the sole of the foot) you can be sure you have either Virulent or Benign Footrot.

There are many strains of the footrot bacteria which vary in their ability to cause disease. Some strains never cause serious footrot in sheep, regardless of the environmental conditions – referred to as benign strains.

Other strains cause severe footrot lesions and spread rapidly in warm, moist environmental conditions – referred to as virulent strains.

In between these two extremes, there is a range of strains with variable ability to cause under-run (Figure 2). All strains of the causative bacteria, *D. nodosus*, appear identical under the microscope.

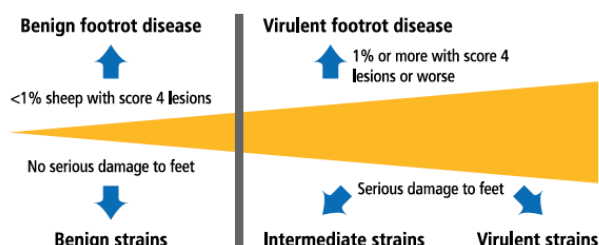


Figure 2: An illustration of the range of strains of footrot based on their ability to cause disease.

<https://www.coopersanimalhealth.com.au/wp-content/uploads/sites/335/2022/06/GetPdf-40.pdf>

The main feature that distinguishes virulent footrot from benign footrot is the proportion of sheep in the mob that have feet with horn separating from the sole of the foot (Table 1).

The main laboratory test to aid diagnosis is the elastase test. This test differentiates between benign and non-benign strains.

A clear **diagnosis of virulent footrot** can be made if $>1\%$ of sheep are affected with Score 4 lesions. Promptly seek expert advice. Note that there may be small variations in the definition of virulent footrot between states.

A **diagnosis of benign footrot** can be made if the proportion of sheep with Score 4 lesions i.e. the horn separating from the sole is less than 1% of sheep (following a normal spring & without treatment). Seek expert advice on diagnosis and control.

Table 1: Distinguishing between benign and virulent footrot.

	Benign	Virulent
Disease severity	mild	severe
Healing when dry	high	low
Lesion scores	1 – 3	3 – 4
Elastase test	≥ 16 days	4-12 days
% sheep $\geq$ score 4	$< 1\%$	$> 1\%$

Footrot Scoring

A five-stage scoring system has been developed to describe the progression of the disease with Score 1 being the earliest stage of infection and Score 5 being the most advanced stage of footrot.

The first stage of infection affects the skin between the toes, (interdigital skin). This skin becomes red and hairless. There is no separation of the horn from the heel or sole of the foot (Score 1 & 2, Figure 3).

Score 3 footrot involves separation of the horn starting at the inside edge of the heel at the skin horn junction and continuing across the heel – referred to as under-run. A grey, creamy coloured paste-like exudate will form between the horn of the sole and underlying soft tissues of the foot and usually has a distinctive, foul smell.

If only mild strains of footrot are involved, then this will be as far as the disease progresses, regardless of the environmental conditions.

With more virulent strains, in a wet, warm environment, the separation of the horn progresses across the heel to the outside wall of the hoof. This progressive under-run is characteristic of more aggressive strains of footrot.

In badly affected sheep, the whole of the heel, sole and wall of the hoof can separate from the foot (Score 4 & 5). Sheep with both front feet affected will often kneel to graze because of the severe pain associated with standing. Figure 2 illustrates the progression of footrot (and respective lesion scores) in the hoof.

Foot scoring system

Figure 3: Sequence of footrot lesion development

SCORE 1: Mild interdigital dermatitis. Slight to moderate inflammation confined to the interdigital skin with erosion of the surface layer of the skin. The skin between the toes is red, moist and shedding hair.



SCORE 2: More extensive interdigital dermatitis. Severe inflammation of the interdigital skin which involves part or all the soft horn of the inside wall of the toe.



SCORE 3: Initial separation at the skin horn junction, with under-run of the soft horn of the heel.



SCORE 3: More extensive separation of the heel but not extending to the outside edge of the sole of the foot.



SCORE 4: Separation extending to the walls and outside edge of the sole of the foot.



SCORE 5: Necrotising inflammation of the deeper tissue of the outside wall with consequent separation of the hard horn of the foot.



What happens in an infected flock?

Not all sheep in an infected flock will be affected by footrot. Even if the footrot is caused by a highly virulent strain, some sheep in the flock will remain free of footrot.

Season and disease expression

During summer, when conditions are warm and dry, the hooves will harden, and many lesions will self-cure. On some feet, horn may grow over the footrot lesion encapsulating the bacteria in pockets in the sheep's feet. Bacteria can survive for many months through summer in these pockets and often cause the feet to be misshapen.

Wet and warm environmental conditions allow better survival of the bacteria in the environment, and wet conditions enable maceration of the interdigital skin. These conditions allow the bacteria to spread between sheep triggering a subsequent outbreak of footrot.

Pattern of disease

The pattern of disease within a flock is mainly determined by the environmental conditions (climate and pasture) and the strain of the footrot bacteria involved.

Some strains of footrot are so mild that they do not cause an economically significant form of the disease. In contrast virulent strains of footrot inevitably result in crippling economic losses. There are major benefits in eradicating these strains from affected flocks.



Ewe displaying lameness in the left foreleg.

Benign strains of footrot

A flock infected with a benign strain will show few signs of footrot most of the year. In dry years there may be no sign of the infection.

The disease is usually most noticeable during spring when some of the sheep may appear lame and have Score 2 & 3 lesions. More than 20% of a mob may be affected with Score 1 & 2 feet but less than 1% progress to Score 4.

As the weather becomes warmer and drier, affected feet will self-cure and there may be no visible sign of infection. This makes it tempting to think the disease has resolved but the footrot bacteria will persist in the feet of a percentage of the flock.

The disease will reappear with the next spell of warm wet weather in the following autumn (sometimes) or spring and cause more lameness.

Benign strains are less likely to cause severe disease and can be well managed with control measures such as footbathing. Eradication is usually not warranted unless for the desire to avoid confusion with the early stages of virulent footrot.

Virulent strains of footrot

A flock infected with a virulent strain may show no signs of footrot until suitable weather causes sudden severe lameness in large numbers of sheep.

Depending on the strain of footrot and environmental conditions this may occur in autumn or at the start of spring. The disease may rapidly progress, and an inspection of the flock will show many sheep suffering from severe under-run lesions. If no control measures are taken, many of the feet will progress to Score 4 or 5 lesions.

Other sheep in the flock will have chronically and badly affected feet (Score 4 or 5) that may become flyblown. Culling these sheep alone during summer will not eradicate the disease.

The footrot bacteria will still be in the feet of many sheep, waiting for the next bout of wet, warm weather to multiply and cause the next disease outbreak.

The first step toward footrot eradication is diagnosis based on visual assessment and laboratory test results confirmed by PIRSA.

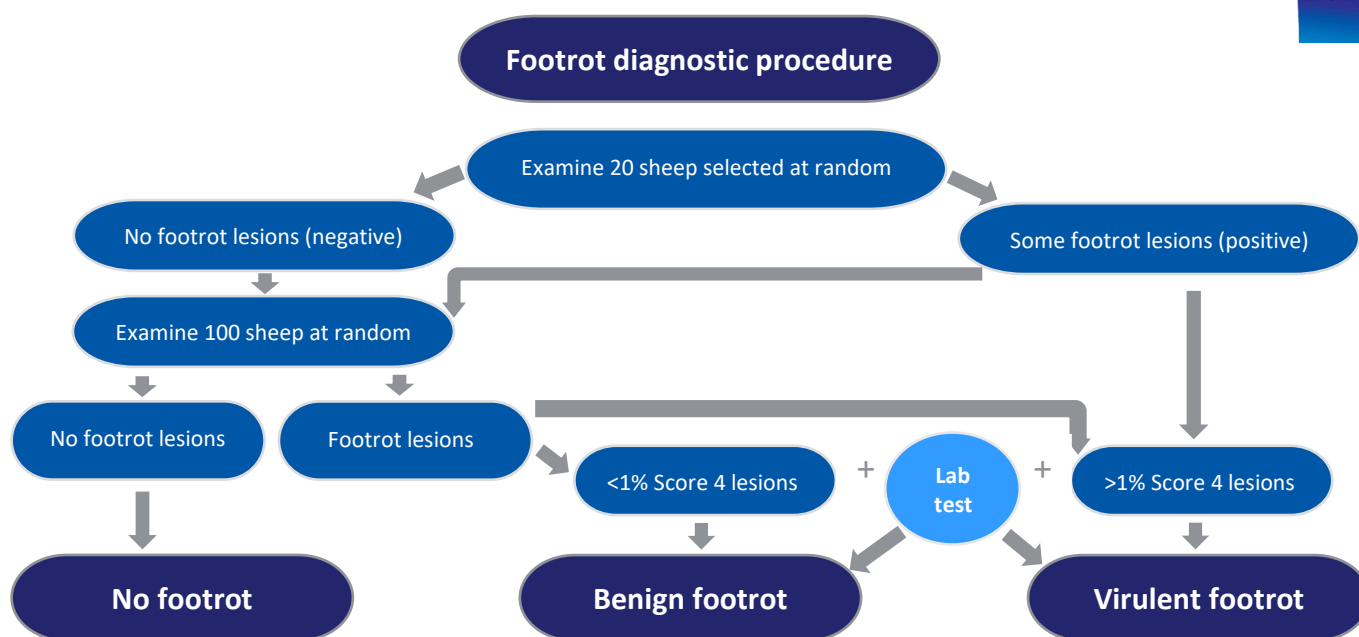


Figure 2: Diagnosing footrot

If a virulent strain is present in an environment that favours expression, then reaching a diagnosis is often easy. Significant under-run lesions are sampled, and a confirmatory positive elastase test result is obtained.

Diagnosis may be more difficult if a benign strain is present or in an environment that doesn't favour expression. This is where examination of larger numbers of sheep as well as laboratory testing is essential. Refer Figure 2 above.

Laboratory diagnosis of footrot

Key messages:

- Footrot is diagnosed in the laboratory using samples taken from lesions in the field.
- The elastase test is used to determine whether footrot is present and the level of virulence of the given strain.
- An additional test can be used to identify the serogroups of bacteria present.

Footrot is clinically diagnosed by evaluating characteristic foot lesions in the field and culturing the footrot bacteria (*Dichelobacter nodosus*) in a laboratory.

A prompt, accurate diagnosis helps to determine the best treatment program to reduce the impacts of the disease. The course of action needed will differ depending on whether benign or virulent footrot is present.

Laboratory tests can determine both the presence and virulence of the footrot bacteria and the 'serogroup'.

There are 10 different serogroups (groups of bacteria containing a common antigen) of footrot bacteria. Immunity to footrot is serogroup-specific, so if sheep are vaccinated with one serogroup-specific vaccine they can still be infected by other serogroups.

Knowing which serogroups exist within a flock is important when considering the use of serogroups-specific vaccines as a control treatment. See Module 4 for more information.

Sampling for laboratory testing is essential when any suspicious lesions are detected in the hoof of a sheep (even Score 1 or 2), unless it can be confidently diagnosed as one of the other causes of lameness (refer Module 4: Treatment and Control of footrot and non-footrot lameness). Contact PIRSA to confirm diagnosis.

References

1. AWI, Footrot: A guide to identification and control in the field. Accessed 15/5/25
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